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- COMMUNIST CHINA -

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[Following is the translation of extracts from an article written by the Foundation Engineering Company, Building-Construction Ministry, in Kung-ch'eng Chien-she (Engineering Construction), Peiping, No. 9, 15th May, 1960, pp 1, 6.]

For many years, to erect a relatively large industrial or residential building on a low bearing capacity loose earth layer, generally wood pile, reinforced concrete pile or other rigid pile to strengthen the foundation were used, so that the load of the building could be distributed through the pile group onto the harder earth layer underneath. When the soft earth layer is rather thick, the load of the building can rely on the friction between the pile group and earth layer for support, but the friction pile group, suspended in the soft earth, obviously cannot reduce the sinking of the building.

Knowing the above situation, and to save great amounts of principal building materials--steel, cement, and timber--and to hasten the sinking and stabilization of foundations, the suggestion made by a famous Soviet foundation expert, Professor Yu. M. A-pieh-lieh-fu [Abileyev], has been followed by applying the new technique of using sand pile to stabilize foundations in deep soft earth layer.

To prove the practical effect of sand pile in stabilizing muddy, clay, soft earth, Prof. Abileyev suggested that a large-scale experiment and study should be conducted on the sand pile at a certain spot in a building site before extending it to the entire construction.

Under the correct guidance of the Party and the upper level and with the great efforts of all comrades, the construction process proceeded satisfactorily, though there were many difficulties. These included reasonable arrangement of water flow during construction, correct amount of sand pouring, regulation of pipe depth, effective measures to dispose of earth, and the effect of soil expansion on the sides.

The achievement of sand pile for stabilizing large area soft earth foundation is an important technical achievement. It is a victory gained under Party guidance and learning from Soviet advanced technique. It is also a great victory for the socialist construction general line and the great leap forward. Through construction practice, preliminary experiences in large area sand pile construction have been accumulated and many lessons have been learned.

To inspect the practical effect of sand pile in deep layer stabilizing soft earth foundation and to analyze and compare data obtained after sand-piling under different water flow procedures, the Foundation Engineering Company, with the cooperation of related units, utilized contact exploration and underground boring methods to conduct tests. There were conducted after construction was completed and were tests of sand pile sections, density, and physical and mechanical properties of the soil located between the sand piles after stabilization took place. At the same time, analysis of the economic effect of the sand piles was conducted. A brief report is given below concerning the results of these tests and analysis:

1. The Section and Density of Sand Pile

The section and density of sand pile directly affect stabilized foundations. Based on the amount of sand actually poured, the average diameter of the sand pile should be 60 centimeters, but actual test has shown taht the diameter of the sand pile in elevation is only 48.46 centimeters. Accordingly, the conclusion has been reached that the sand pile must have the shape of a cucumber, the upper part is small while the lower part is larger. The diameter of the lower portion must be much greater than designed measurement. This formation is made by the fact that the sand, when it is saturated, sinks down of its own weight. Also, because the pipe sinks a second time, the conical valved pile cap compresses loose sand down around the upper part; thus, the lower part of the sand pile has a larger formation. These factors naturally lead unequal amounts of yellow sand at different earth levels to affect the even stabilization of the sand pile. (There is another factor that affects the even stabilization of the sand pile. The proportion of clay in the foundation soil and the difference in depth of the soft earth layer have a serious effect on sand pile stabilization.)

The density of sand pile is controlled by the capa-

city weight of the sand. According to Prof. Abileyev, sand capacity weight should not be less than 1.62 tons per cubic meter. Test records after construction have shown that sand capacity weight has been 1.62 tons/cubic meter, which meets quality requirements. It is realized that by using a vibration-type pile driver for construction, pulling the pipe out at the rate of 1.5-3.0 meters per minute, and relying on the repeated hitting of a single steam hammer, the yellow sand will fall into proper density as required by regulations.

2. The Contact Exploration Test

The contact exploration test is used to inspect the stabilized sand pile. It can be conducted very conveniently on the head of a boring lever. Use a 62.5 kilogram hammer and let it fall from the height of 76.8 centimeters (30 inches) along a guide post, rendering a hit of 4,800 kilograms per centimeter. Record the number of hits that are required to put the boring lever 30 centimeters into the earth. A record is kept for every depth of 30 centimeters that the lever has gone into the earth. Then, evaluate the density of the sand pile or the soil from these data.

After the completion of this construction, a contact exploration test was made at 34 points, where the vertical line and water flow are different. According to the analysis of test effects, it is understood that when a sand pile has a depth within 5 meters, it has a medium density and the portion beyond 5 meters has a solid density. In the depth of 4-6 meters under ground, the sand pile has very little effect on the density of the soil, but its effect is very obvious beyond that depth; when two different construction methods are applied to different water flow procedures, their stabilized density is the same. The number of hammer hits on the sand pile itself and that on the soil between two piles come very close.

3. Underground Boring Exploration Test

To understand further the changes in physical and mechanical properties of the sand pile after the foundation has been stabilized, an underground boring exploration test has been conducted. After analyzing the test results, the following conclusions have been arrived:

1) After sand pile stabilization, the saturated clay has gained a definite degree of density. Its physical and mechanical properties have obvious improve-

ments.

2) A comparison of the physical and mechanical properties of the soil taken from certain holes with these data, shows that is is possible to extend the distance between the piles, thereby the progress of construction will be hastened and construction cost reduced.

3) Comparing the physical and mechanical properties of the soil after actual construction has begun, the result has proved that the water flow construction method (no jump hit on two neighboring piles) may be extensively adopted.

4. Economic Effects

Sand pile stabilization of soft earth foundation can save a great amount of principal building materials. This has an important meaning to socialist construction. It is sufficient to review the above construction project, which shows that the sand pile stabilized foundation method has saved the state 1,093 tons of steel, 2,300 tons of cement, and 166 cubic meters of timber..

But it must be pointed out that this is the first application of this method, the piles are too close, too much sand is used, experience is lacking in such construction, the cost of sand transportation is rather high, so, the total production cost has not been reduced to the expected level.

However, it is believed that after further test and study, if improvement can be realized in sand pile planning and construction machinese, the construction cost of sand pile stabilized foundations will be greatly reduced. It is especially true in areas where sand is plentiful, hence costs will be even lower. It is believed that the new technique of sand pile stabilized foundation, under certain conditions and in certain areas, is worthy of develpment.

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